

APPLICATION FOR  
UNITED STATES LETTERS PATENT

SPECIFICATION

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TO ALL WHOM IT MAY CONCERN:

Be it known that I, Carl Ron Kafka, a citizen of Canada, and resident of the Province of Alberta, having a postal address of 1719 Pine Tree Crescent, NE, Calgary, Alberta, T1Y 1L6, have invented a new and useful **"Rolling Pig Pipeline Cleaning Apparatus"**, of which the following forms the specification.

## **“Rolling Pig Pipeline Cleaning Apparatus”**

### **BACKGROUND OF THE INVENTION**

#### **CROSS REFERENCE TO RELATED APPLICATIONS**

Not applicable.

#### **5 Field of the Invention**

The present invention relates to the field of pipeline cleaning systems in general and in particular to an automated rolling pig conveyor and delivery system for pipelines.

#### **Description of Related Art**

10 As can be seen by reference to the following U.S. Patent Nos. 5,442,826; 5,674,323; 6,085,376; 4,720,884; and 4,016,620, the prior art is replete with both pig constructions per se, as well as, the delivery systems used to inject a pig through a pipeline.

15 While all of the aforementioned prior art constructions are more than adequate for the basic purpose and function for which they have been specifically designed, they are uniformly deficient with respect to their failure to provide a simple, efficient, and practical rolling conveyor system that feeds a plurality of pigs in a sequential fashion into an automated delivery system that introduces the individual pigs under pressure into a pipeline.

20 As anyone in a pipeline related industry is all too well aware, routine periodic maintenance of the pipeline requires that a pig be injected under high pressure

through the pipeline to remove accumulated material from the interior surfaces of the pipeline. Usually the process requires the manual or automated loading of a single pig into a high pressure injection system over widely spaced time intervals. However, there are other applications that require the sequential loading of pigs over shorter time intervals and it is those specialized applications that this invention is intended to address.

As a consequence of the foregoing situation, there has existed a longstanding need in certain pipeline environments for a new and improved rolling pig pipeline cleaning apparatus that delivers a plurality of pigs in a sequential fashion into a high pressure injection system that forces the individual pigs through a pipeline and the provision of such an apparatus is the stated objective of the present invention.

#### BRIEF SUMMARY OF THE INVENTION

Briefly stated, the rolling pig pipeline cleaning apparatus that forms the basis of the present invention comprises in general a pig conveyor unit, a high pressure delivery unit and a control unit.

As will be explained in greater detail further on in the specification, the pig conveyor unit comprises a framework including a base member having a plurality of vertical support columns each equipped with a plurality of support arms that support opposed pairs of guide rails that provide a rolling pathway for a plurality of gravity fed pigs which are delivered to an indexing arrangement that allows the pigs to exit from the guide rails in a sequential fashion.

The high pressure delivery unit comprises a pig catching chamber dimensioned to accept individual pigs wherein, one end of the pig catching chamber is axially aligned with a retractable pig pushing ram that will deliver the individual pigs into a high pressure chamber that is in communication with a pressure generating chamber controlled by an actuator to deliver high pressure gas from the pressure generating chamber into the high pressure chamber for propelling a pig through a pig feeding tube into a pipeline.

## BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

These and other attributes of the invention will become more clear upon a thorough study of the following description of the best mode for carrying out the invention, particularly when reviewed in conjunction with the drawings, wherein:

- 5           FIG. 1 is an isolated perspective view of the rolling pig conveyor unit;  
          FIG. 2 is a front perspective view of the pipeline cleaning apparatus;  
          FIG. 3 is a schematic diagram of the pig delivery system;  
          FIG. 4 is an enlarged structural detail view of one of the magnetic limit switches employed in the control unit;
- 10          FIG. 5 is an enlarged structural detail view of the pig catcher;  
          FIG. 6 is an enlarged structural detail view of the high pressure delivery system; and,  
          FIG. 7 is an enlarged structural detail view of the cylinder separator member.

## DETAILED DESCRIPTION OF THE INVENTION

- 15          As can be seen by reference to the drawings, and in particular to FIG. 2, the rolling pig pipeline cleaning apparatus that forms the basis of the present invention is designated generally by the reference number **10**. The apparatus **10** comprises in general a pig conveyor unit **11**, a high pressure delivery unit **12**, and a control unit **13**. These units will now be described in seriatim fashion.

- 20          As shown in Figs. 1, 2, 5, and 7, the pig conveyor unit **11** comprises in general a framework including a generally T-shaped base member **20** that supports a plurality of vertical support columns **21** disposed in spaced pairs along the stem portion **22** of the base member **20** wherein, each of the support columns **21** is provided with three inwardly directed support arms **23** disposed at staggered intervals on the support
- 25          columns **21** for the purpose of supporting a plurality of elongated guide rails **24**.

- As can best be appreciated by reference to Fig. 1, the front pair **21 21** and the intermediate pair **21' 21'** of support columns have generally straight support arms **23 23'** wherein, the rear pair of support columns **21'' 21''** is provided with a lower pair of straight support arms **23''** and two pairs of generally L-shaped support arms **23''** for
- 30          reasons that will be explained presently.

Still referring to Fig. 1, it can be seen that the front support columns **21 21** have the most widely spaced support arms **23** and the rear support columns **21"** have the most closely spaced support arms **23"** and **23"** which provide support for two pairs of rearwardly inclined upper guide rails **24** and **24'** and a pair of forwardly inclined lower guide rails **24"** that are designed to provide a gravity feed pathway for a plurality of contoured pigs **25**.

Turning now to Figs. 1 and 7, it can be seen that the rear support columns **21"** **21"** are further provided with a rearwardly spaced backing plate **26** attached to the rear support columns **21"** **21"** by spacer arms **27** wherein, the L-shaped support arms **23"** and the backing plate **26** define a chute opening that allows the pigs **25** to travel from the upper guide rails **24 24** and **24' 24'** to the lower guide rails **24"** **24"** in a well recognized fashion to deliver the pigs **25** to the cross-arm portion **27** on the front of the T-shaped base **20**.

Turning now to Figs. 2, 5, and 6, it can be seen that the high pressure delivery unit **12** comprises in general a cylindrical pig catching chamber **30** provided with a hinged lid **31** that automatically closes once a pig **25** is released from the front end of the lower guide rails **24"** via an indexing cylinder arrangement **28** that only allows one pig **25** at a time to be fed into the pig catching chamber **30**.

As can also be best appreciated by reference to Fig. 2, one end of the pig catching chamber **30** is aligned with and operatively connected to a pig pushing ram **32** and the other end of the pig catching chamber **30** is aligned with a pig delivery tube **33** wherein, a high pressure chamber **34** is disposed intermediate the pig catching chamber **30** and the pig delivery tube **33**.

In operation, the pig pushing ram **32** is fully retracted to the position illustrated in Fig. 2 wherein, a magnetic limit switch **40** is triggered to allow the indexing cylinder arrangement **28** to deliver a single pig **25** into the pig catching chamber **30**. Then once the pig **25** is received in the chamber **30**, the lid **31** is closed and the pushing ram **32** is actuated to drive the pig **25** out of the catching chamber **30** through the high pressure chamber **34** and into the pig delivery tube **33**.

The ram **32** must be fully retracted before high pressure gas is introduced into the high pressure chamber **34** via a pressure generation cylinder **35** that is controlled

by an actuator **44** that opens a ball valve **36** to introduce high pressure gas into the high pressure chamber **34** to propel the pig **25** through the pig delivery tube **33** and into a pipeline.

5       Turning now to Figs. 3 through 6, it can be seen that the control unit **13**  
comprises in general a pair of magnetic limit switches **40 41** that controls the  
extension and retraction of the pushing ram **32**, a pair of sensors **42 43** that purges  
the high pressure chamber with nitrogen gas and an actuator **44** that responds to the  
sensors **42 43** to open the ball valve **36** to allow pressurized gas from the pressure  
generation cylinder **35** to enter into the high pressure chamber **35** to propel the pig **25**  
10       through a pipeline (not shown) in a well recognized manner.

Although only an exemplary embodiment of the invention has been described  
in detail above, those skilled in the art will readily appreciate that many modifications  
are possible without materially departing from the novel teachings and advantages of  
this invention. Accordingly, all such modifications are intended to be included within  
15       the scope of this invention as defined in the following claims.

Having thereby described the subject matter of the present invention, it should  
be apparent that many substitutions, modifications, and variations of the invention are  
possible in light of the above teachings. It is therefore to be understood that the  
invention as taught and described herein is only to be limited to the extent of the  
20       breadth and scope of the appended claims.